



New Jersey Department of Health and Senior Services

# HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **SARIN**

CAS Number: 107-44-8

DOT Number: UN 2810

RTK Substance number: 2757

Date: April 2004

## HAZARD SUMMARY

- \* **Sarin** can affect you when breathed in and quickly enters the body by passing through the skin.
- \* Contact can severely irritate and burn the skin and eyes.
- \* Breathing **Sarin** can irritate the nose and throat.
- \* Breathing **Sarin** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- \* Exposure to **Sarin** can cause rapid, *FATAL Organophosphate poisoning* with headache, sweating, nausea, vomiting, diarrhea, loss of coordination, and death.
- \* **Sarin** may damage the nervous system causing numbness, "pins and needles," and/or weakness in the hands and feet.
- \* High exposure may affect the brain and heart causing irregular heartbeats (arrhythmias).

## IDENTIFICATION

**Sarin** is an odorless liquid. It is used as a nerve gas and chemical warfare agent.

## REASON FOR CITATION

- \* **Sarin** is on the Hazardous Substance List because it is cited by DEP and EPA.
- \* Definitions are provided on page 5.

## HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- \* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- \* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

## WORKPLACE EXPOSURE LIMITS

The United States military suggests a permissible airborne concentration of **0.0001 mg/m<sup>3</sup>** for an 8-hour workday or a 40-hour work week.

- \* As **Sarin** is absorbed through your skin, contact should be eliminated.

## WAYS OF REDUCING EXPOSURE

- \* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- \* A regulated, marked area should be established where **Sarin** is handled, used, or stored.
- \* Wear protective work clothing.
- \* Wash thoroughly immediately after exposure to **Sarin** and at the end of the workshift.
- \* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Sarin** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

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## HEALTH HAZARD INFORMATION

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Sarin**:

- \* Contact can severely irritate and burn the skin and eyes.
- \* Breathing **Sarin** can irritate the nose and throat.
- \* Breathing **Sarin** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- \* Exposure to **Sarin** can cause rapid, FATAL, *Organophosphate poisoning* with headache, dizziness, blurred vision, tightness in the chest, sweating, nausea, vomiting, diarrhea, muscle twitching, loss of coordination, convulsions, coma and death.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Sarin** and can last for months or years:

### Cancer Hazard

- \* According to the information presently available to the New Jersey Department of Health and Senior Services, **Sarin** has not been tested for its ability to cause cancer in animals.

### Reproductive Hazard

- \* According to the information presently available to the New Jersey Department of Health and Senior Services, **Sarin** has not been tested for its ability to affect reproduction.

### Other Long-Term Effects

- \* **Sarin** may damage the nervous system causing numbness, "pins and needles," and/or weakness in the hands and feet.
- \* High exposure may affect the brain and heart causing irregular heartbeats (arrhythmias).

## MEDICAL

### Medical Testing

Before employment and at regular times after that, the following are recommended:

- \* Plasma and red blood cell cholinesterase levels (tests for the enzyme poisoned by this chemical). If exposure stops, plasma levels return to normal in 1-2 weeks while red blood cell levels may be reduced for 1-3 months.

- \* When cholinesterase enzyme levels are reduced by 25% or more below pre-employment levels, risk of poisoning is increased, even if results are in lower ranges of "normal." Reassignment to work not involving *Organophosphate* or *Carbamate* pesticides is recommended until enzyme levels recover.

If symptoms develop or overexposure occurs, repeat the preceding tests as soon as possible and get an exam of the nervous system.

Also consider:

- \* Consider chest x-ray after acute overexposure.
- \* EKG.
- \* EEG.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

### Mixed Exposures

- \* Persons exposed to other chemicals which affect body cholinesterase (*Organophosphates*, *Carbamates*) may be at increased risk.

## WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

- \* Automatically pump liquid **Sarin** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

- \* Workers whose clothing has been contaminated by **Sarin** should change into clean clothing promptly.

- \* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Sarin**.
- \* Eye wash fountains should be provided in the immediate work area for emergency use.
- \* If there is the possibility of skin exposure, emergency shower facilities should be provided.
- \* On skin contact with **Sarin**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Sarin**, whether or not known skin contact has occurred.
- \* Do not eat, smoke, or drink where **Sarin** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.

## PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Clothing

- \* Avoid skin contact with **Sarin**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- \* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- \* The United States military recommends *Butyl Rubber* gloves over *Nitrile* or *Latex* gloves and Responder® and Tychem® BR/LV, SL or TK level suits.

### Eye Protection

- \* Eye protection is included in the recommended respiratory protection.

### Respiratory Protection

**IMPROPER USE OF RESPIRATORS IS DANGEROUS.** Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- \* Exposure to **Sarin** can be immediately dangerous to life and health (IDLH). If the possibility of exposure to **Sarin** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

## HANDLING AND STORAGE

- \* Prior to working with **Sarin** you should be trained on its proper handling and storage.
- \* A regulated, marked area should be established where **Sarin** is handled, used, or stored.
- \* **Sarin** will react with WATER or STEAM to produce toxic and corrosive gases.
- \* **Sarin** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); TIN; MAGNESIUM; CADMIUM PLATED STEEL; COPPER; BRASS; and LEAD.
- \* Store in tightly closed containers in a cool, well-ventilated area.

## QUESTIONS AND ANSWERS

- Q: If I have acute health effects, will I later get chronic health effects?
- A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.
- Q: Can I get long-term effects without ever having short-term effects?
- A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.
- Q: What are my chances of getting sick when I have been exposed to chemicals?
- A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.
- Q: When are higher exposures more likely?
- A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).
- Q: Is the risk of getting sick higher for workers than for community residents?
- A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

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The following information is available from:

New Jersey Department of Health and Senior Services  
Occupational Health Service  
PO Box 360  
Trenton, NJ 08625-0360  
(609) 984-1863  
(609) 984-7407 (fax)

Web address: <http://www.state.nj.us/health/eoh/odisweb/>

#### **Industrial Hygiene Information**

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

#### **Medical Evaluation**

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

#### **Public Presentations**

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

#### **Right to Know Information Resources**

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

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## DEFINITIONS

**ACGIH** is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

**CFR** is the Code of Federal Regulations, which consists of the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

**IRIS** is the Integrated Risk Information System database of the federal EPA.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

**mg/m<sup>3</sup>** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NAERG** is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEL** is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

**PIH** is a DOT designation for chemicals which are Poison Inhalation Hazards.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**TLV** is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Common Name: **SARIN**  
DOT Number: **UN 2810**  
NAERG Code: **153**  
CAS Number: **107-44-8**

Hazard rating	NJDHSS	NFPA
<b>FLAMMABILITY</b>	1	-
<b>REACTIVITY</b>	1	-
NERVE GAS POISONOUS GASES ARE PRODUCED IN FIRE		

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

## FIRE HAZARDS

- \* **Sarin** may burn, but does not readily ignite.
- \* Use dry chemical, CO<sub>2</sub>, water mist or foam extinguishers. DO NOT use methods that will cause splashing or spreading of **Sarin**.
- \* POISONOUS GASES ARE PRODUCED IN FIRE, including *Phosphorus Oxides, Fluorides and Propylene*.
- \* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

## SPILLS AND EMERGENCIES

If **Sarin** is spilled or leaked, take the following steps:

- \* Evacuate persons not wearing full protective equipment from area of spill or leak until clean-up is complete.
- \* Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- \* Ventilate and wash area after clean-up is complete.
- \* Only specially trained personnel should neutralize **Sarin**.
- \* It may be necessary to contain and dispose of **Sarin** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- \* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300  
NJDEP HOTLINE: 1-877-WARN-DEP

## HANDLING AND STORAGE (See page 3)

## FIRST AID

***For POISON INFORMATION call 1-800-222-1222***

## Eye Contact

- \* Immediately flush with large amounts of water. Continue without stopping for at least 30 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.

## Skin Contact

- \* Quickly remove contaminated clothing. Immediately wash area with large amounts of soap and water. Seek medical attention immediately.
- \* Shampoo hair promptly if contaminated.

## Breathing

- \* Remove the person from exposure.
- \* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- \* Transfer promptly to a medical facility.
- \* Medical observation is recommended for 24 to 48 hours after breathing overexposure, as pulmonary edema may be delayed.
- \* If exposure and/or symptoms have occurred, the person should be under medical observation for several days as some symptoms may be delayed.

## Antidotes and Special Procedures

- \* In case of severe poisoning, consider administration of *Atropine* and *Pralidoxime* in a medical facility.

## PHYSICAL DATA

**Vapor Pressure:** 1.48 mm Hg at 68°F (20°C)

**Flash Point:** greater than 280°F (138°C)

**Water Solubility:** Miscible (mixes in water)

### OTHER COMMONLY USED NAMES

**Chemical Name:**

Phosphonofluoridic Acid, Methyl-, Isopropyl Ester

**Other Names:**

GB: Isopropoxymethylphosphoryl Fluoride

*Not intended to be copied and sold for commercial purposes.*

NEW JERSEY DEPARTMENT OF HEALTH AND  
SENIOR SERVICES

## Right to Know Program

PO Box 368, Trenton, NJ 08625-0368  
(609) 984-2202